

XIX. *Remarks on the homologies and differences between the first stages of Pericoma, Hal., and those of the new Brazilian species.* By Baron C. R. OSTEN SACKEN, Ph.D., Hon. F.E.S.

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THE introductory paragraph of Dr. Müller's paper sufficiently explains its scope, which is to call attention to a group of very remarkable aquatic larvæ of *Psychodidæ*, discovered by him in 1881 in the environs of his residence in Southern Brazil, but of which he was unable, at that time, to make a more thorough investigation. He has already made a short allusion to these larvæ in the "Zool. Anzeiger," 1881, p. 499 (compare also Bertkau's Entomol. Bericht, 1881, p. 145), and has called attention to their remarkable structural analogies with the larvæ of *Blepharoceridæ*, which occur in the same running waters. Since then, in the "Entomologische Nachrichten," Berlin, 1888, p. 273, Dr. F. Müller has published a short article, accompanied by three figures, on the mode of breathing of two species of the same larvæ.

What Dr. Müller offers us at present is a set of drawings of the early stages of the said *Psychodidæ*, prepared in 1881, but never published. They are accompanied by an explanatory notice. The study of these insects is of extraordinary interest as a most remarkable instance of the power of adaptation among aquatic larvæ; but in order fully to bring out this interest, they should be compared with some ordinary type of *Psychodid* larva. The present volume of the Transactions affords us the best occasion for such a comparison, as it contains the only scientifically satisfactory description of such a larva in Prof. L. C. Miall's and Norman Walker's paper: "The Life-history of *Pericoma canescens*." I shall therefore attempt such a comparison.

The principal of Dr. Müller's figures (Tab. x., fig. 1) represents, much magnified, a dorsal view of the larva of

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a species to which the author has given the provisional name of *Maruina ursula*. When we compare it with Prof. Miall's figure (Tab. iii., fig. 1) of the larva of *P. canescens*, and read the description (pp. 142-144) the resemblance between the two larvæ becomes apparent. About *P. canescens* we read: "The head is rather small and completely exserted. On its upper surface the triangular clypeus, pointed behind, occupies a central position; it is flanked by the two epicranial plates. . . . On the sides of the head, behind the antennæ, are the eye-spots, which are oval, convex, pigmented." These passages concerning *P. canescens* are equally applicable both to the head of Dr. Müller's larva (Tab. x., fig. 1), as to the detail-head of fig. 3 (of *Maruina pilosella*). On the anterior dorsal part of the thorax we perceive, in Miall's Tab. iii., fig. 1 (*P. canescens*) as well as in Dr. Müller's Tab. x., fig. 1 (*M. ursula*), contiguous triangular chitinous plates, with a narrow interval between them; the structural analogy is evident, although the differences are easily perceptible.

The other thoracic segments of the larva of *P. canescens* are described and figured as consisting each of two annuli, separated by transverse constrictions, each annulus bearing a narrow, transversely set dorsal shield. Two such transverse shields are visible on the thorax of the South American larva (fig. 1, *M. ursula*) behind the above-mentioned triangular plates. The abdominal segments (*P. canescens*) are subdivided into three annuli (except the first, which has only two), and each of these annuli bears a transverse chitinous shield, like those of the thorax (Tab. iv., fig. 4). The abdominal segments of the three South American larvæ are described very nearly in the same terms by Dr. Müller: "The three species show three dorsal shields on each of the dorsal segments of the abdomen, and, laterally, these segments are very distinctly divided into three lobes" (compare Tab. x., fig. 4, the fifth abdominal segment of *M. pilosella* from above). The skin of the larva of *P. canescens* is described (p. 142) as: "Covered with chitinous tubercles, for the most part very minute. These appear under the microscope like nails, imbedded in the flexible skin. They take various shapes," etc. The dotted surface of the skin of the larva of *M. ursula* (fig. 1) may represent a similar structure, although it is

not mentioned in Dr. Müller's letterpress. The larva of *P. canescens* has, on the sides, "long and stiff hairs, all pointing backwards, like those which project from the dorsal shields" and probably intended to "save the larva from being swept away by a sudden rush of water." Similar setæ and hairs on the sides and at the ends of the chitinous transverse plates are visible in the larva of *M. ursula*, but they are much longer than those of *canescens*, some of them being as long as the whole breadth of the larva. In this respect, the two other larvæ (*M. pilosella* and *spinosa*) come nearer to *P. canescens* in the shortness of their appendages: "their abdominal segments," says Dr. Müller, "are beset on the sides with straight spines" (Dornen), the length of which is far less than half the breadth of the abdomen; in one of the species *M. pilosella* (figs. 2, 3, 4) these spines are simple, in the other (*M. spinosa*) they bear from four to six and even seven branches.

The dorsal view of the two larvæ (at least in the figures) shows a difference in the structure of the breathing organs. *P. canescens* shows, on the prothorax, a pair of projecting cylindrical tubes, which are the anterior spiracles. In *M. ursula* such tubes are not visible. The anal breathing apparatus in the *Marulin*-larvæ is represented by the two types of structure, which have already been mentioned above as described and figured in the "Entom. Nachrichten."

One of the larvæ (*M. pilosella*) can breathe either directly, through a pair of anal spiracles, or, when under water, by means of three pairs of branchial appendages (tracheal gills), compare Tab. x., fig. 2; and also in the Ent. Nachr., 1888, the figures *A* and *B*. The other larva (*M. ursula*, Tab. x., fig. 1 L; and Ent. Nachr., 1888, fig. *C*) has two tracheal trunks inside a tubular elongation of the last abdominal segment, with a circular fringe of hairs around its opening, that enables the larva to hold a bubble of air when it is under water. Short branchial appendages, apparently only a pair on each side, and not three as in *M. pilosella*, protrude a little above the opening of the spiracle tube.

The apparatus in *P. canescens* is somewhat different, consisting, at the end of the body, of two pairs of anal processes, "chitinous rods, bearing a fringe of fine filaments, which project from the sides and tip" (Tab.

iii., fig. 1, and iv., figs. 5-7), the outspread fringes of the four processes, when under water, "form a cup, filled with air, and from this air can be taken into the spiracle."

All these appliances are adapted for enabling the larva to breathe the gaseous air through spiracles, or to get it under water, either by means of an artificial cup, which holds a bubble, or else by means of branchial appendages. It is well known now that such a combination of breathing appliances in the same species is of rather common occurrence among aquatic larvæ of Diptera.

We have, hitherto, examined the *dorsal* side of the four larvæ and discovered resemblances which evidently depend upon similar conditions of life in running waters. The *ventral* side of the larvæ of *Maruina*, as well as their pupa-state show considerable, and, as to their usefulness, as yet unexplained differences from the larva and pupa of *P. canescens*.

The ventral side of the *Maruina*-larvæ is described thus (compare above, Dr. Müller's letterpress): "The three species are provided with a longitudinal row of six suctorial discs, the last of which occupies the penultimate ventral segment (Tab. x., fig. 2). Concerning the structure of these discs, I can only refer to the figures (6 and 7), as, at present, I have no other descriptive data at hand."

There is nothing like these suctorial discs in the larva of *P. canescens* (Tab. iii., fig. 2). The ventral side is described as follows: "The ventral surface is more uniformly covered with tubercles and setæ. A pair of small and distinct plates, which appear to be more solid than the neighbouring integument, defend the middle annulus of most of the abdominal segments on the ventral side, lying within the shield." (Miall, p. 143 at top.)

Much greater is the difference between the pupa of *P. canescens* and that of the South American *Maruinæ*. The former is very much like most of the pupæ of the Nematocera, especially the *Tipulidæ* (Tab. iii., fig. 3); it has a flexible abdomen, the segments of which are provided with circles of hooks, and some larger spines, for locomotion. The pupa of *M. pilosella* (Tab. xi., fig. 8) is shield-like, flat, adherent, and, apparently, unfit for

locomotion. It has some resemblance to the *Blepharocerid* larva of *Curupira*, figured by Dr. Müller in the *Archivios*, etc., Rio Jan. iv., Tab. viii., figs. 2, 3; but, besides other evident differences, it is flat, and not roof-like like the other.

Dr. Müller describes as follows the mode of life of the *Curupira* and *Maruina*-larvæ (compare above): "While the *Curupira*-larvæ are fastened to bare rocks, from which the water falls down perpendicularly, the *Maruina*-larvæ live on rocky walls, which, constantly moistened by drops of water running down upon them, or by the spray of the waterfalls, become covered with a thin, slippery, growth of algæ." The prime necessity of such larvæ and pupæ must be therefore that of clinging to their place, and this necessity may perhaps explain the development of suctorial discs in both classes of larvæ (*Blepharoceridæ* and *Maruina*), as well as the shape of the pupæ, fitted for adhesion, and therefore flattened, at least on one side. These habits appear quite different from those of the larvæ of *P. canescens*, as described in detail by Prof. Miall (pp. 144-146). In case of a heavy rain, for instance, which deepens the water and increases the force of the current, the larva has several alternatives. "It can cling to the weeds and remain submerged for hours. It can leave the water altogether and creep upon the wet herbage," etc. "When the time of pupation is at hand the larva quits the water; it either burrows into the bank, or climbs upon a stone which rises well above the water, and there pupates." Such motions, generally in a horizontal direction are quicker, and require a different mechanism than a slow, creeping motion along a slippery perpendicular surface.

I should not be surprised that, by using the method of catching *Maruina*-larvæ recommended by Dr. Müller, similar larvæ should be discovered in Europe. Aquatic larvæ are often cosmopolitan.